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32011-165642

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/639,163	08/16/2000	Kaori Tai	32011-165642	3981

26694 7590 10/07/2002

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EXAMINER
COLEMAN, WILLIAM D

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 10/07/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

DOCKETED
Final Rejection and/or Notice of Appeal
CLIENT/MATTER #32011-165642 ATTY JRB
DUE DATE 01/07/2003
FINAL DEADLINE 04/07/2003
DKTED BY BN MC

RECEIVED
OCT - 9 2002
MC
VENABLE IP DOCKETING DEPARTMENT

Office Action Summary	Application No.	Applicant(s)	
	09/639,163	TAI, KAORI	
	Examiner	Art Unit	
	W. David Coleman	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 August 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) *17-18* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☒ The proposed drawing correction filed on *16 August 2002* is: a)☒ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☒ Interview Summary (PTO-413) Paper No(s). *12* .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Interview

1. Applicant's representative telephoned the Examiner of record to inquire about the Advisory action mailed September 24, 2002. The Advisory Action was improper because a Final Rejection was not mailed prior the Advisory Action.

Drawings

2. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on August 16, 2002 have been approved. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance.

Response to Arguments

3. Applicant's arguments filed August 16, 2002 have been fully considered but they are not persuasive.

4. Pertaining to claims 1, 4, 5 and 8, Applicant contends that the combined teachings of Applicant's admitted prior art combined with Derderian et al., U.S. Patent 6,245,191 fails to teach Applicant's invention (i.e., etching using a hydrogen peroxide-water mixture). Applicant further contends that Derderian is not directed to the production of semiconductors and makes no disclosure or suggestion of a cobalt film formed under a titanium or titanium nitride film.

5. In response to Applicants' argument that Derderian is not directed to the production of semiconductors, please see column 1, lines 16-20. Derderian teaches an etching process for the microlelectronics industry and therefore is pertinent to Applicant's invention.

6. Applicant contends that there is no mention in Derderian that a hydrogen peroxide-water mixture may be used to etch titanium or titanium nitride film on a cobalt film without damaging the cobalt film.

7. In response to Applicants contention that Derderian fails to teach a hydrogen peroxide – water mixture to etch titanium nitride, the argument is noted, however moot. Derderian specifically teaches that titanium nitride can be etch by a solution of hydrogen peroxide solution in water (column 4, lines 46-52).

8. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the Applicant admits that it is well known to cover a cobalt silicide with a titanium nitride and Derderian discloses that titanium nitride is etched by a hydrogen peroxide solution mixed with water.

. *Claim Rejections - 35 USC § 103*

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 1, 4, 5, 9, 12, 13 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicants admitted prior art in view of Derderian et al., U.S. Patent 6,245,191.

11. Applicant's admitted prior art discloses a semiconductor method substantially as claimed.

Pertaining to claims 1 and 8, Applicant's admitted prior art teaches a method of producing semiconductor devices by cobalt silicide technology with titanium nitride film as the cap film, comprising:

removing titanium nitride film **112** using a ammonium-hydrogen peroxide-water mixture (see disclosure page 3, lines 17-19). However, Applicants admitted prior art fails to omit the ammonium in the etching step. Derderian teaches removing a titanium nitride film comprising a 30% hydrogen peroxide solution in water (column 4, lines 40-50). In view of Derderian, it would have been obvious to one of ordinary skill in the art to use only a hydrogen-peroxide and water mixture in Applicant's admitted prior art because characteristic parameters of the etching solution droplet include the chemical potential, such as surface tension, chemical reactant and reaction product boundary layers within the etching solution (column 4, lines 25-49).

12. Pertaining to claims 4 and 5, Applicant's admitted prior art teaches a method of producing semiconductor devices, comprising:

forming cobalt film **110** on the top surface of a silicon substrate **100**, which has a gate electrode **108** and a diffusion layer **102**;

forming titanium nitride **112** as the cap film on the top surface of cobalt film **110**;

selectively reacting the silicon of silicon substrate **100** and the cobalt film **110**; and

removing titanium nitride film **112** using ammonium hydrogen peroxide-water mixture (see disclosure, page 3, lines 17-19). However, Applicants admitted prior art teaches fails to

omit the ammonium in the etching step. Derderian teaches removing a titanium nitride film comprising a 30% hydrogen peroxide solution in water (column 4, lines 40-50). In view of Derderian, it would have been obvious to one of ordinary skill in the art to use only a hydrogen-peroxide and water mixture in Applicant's admitted prior art because under ideal conditions, a bead of etching solution droplet would react completely with film 20 with all available etchant within etching solution droplet and contact angle *theta* would remain substantially orthogonal to the plane of film being etched (column 5, lines 44-47).

13. Pertaining to claims 9, 12, 13 and 16 Applicants admitted prior art discloses a semiconductor process substantially as claimed as discussed above. Applicant's admitted prior art teaches forming cobalt film **110** on the top surface of a silicon substrate **100**, which has a gate electrode **108** and a diffusion layer **102**;

forming titanium nitride **112** as the cap film on the top surface of cobalt film **110**;

selectively reacting the silicon of silicon substrate **100** and the cobalt film **110**; and

removing titanium nitride film **112** (first portion) using a hydrogen peroxide-water mixture (see disclosure, page 3, lines 17-19). However, Applicant's admitted prior art fails to disclose a second portion of the titanium nitride film remaining after the first removal step and removing the second portion. Derderian teaches a removing a second portion of said titanium nitride film as claimed by Applicant. See column 3, lines 6-24, where Derderian teaches replenishing the etching solution. In view of Derderian, it would have been obvious to one of ordinary skill in the are to replenish (please note that the term "replenished as used by Derderian is the equivalent of "repeat") the etching solution on Applicants admitted prior art because replenishing the etching solution droplet, while keeping the droplet of a uniform size, maintains a

uniform etching chemistry as the etching solution droplet would otherwise constantly change in its chemistry as it etches material from the surface being etched (column 3, lines 7-12).

14. Claims 2, 3, 6, 7, 10, 11, 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art in view of Derderian et al., U.S. Patent 6,245,191 B1 as applied to claims 1, 4, 5 and 8 above, and further in view of the following comments.

15. Pertaining to claims 2, 3, 6, 7, 10, 11, 14 and 15, Applicants admitted prior art discloses a semiconductor process substantially as claimed as discussed above. Given the teaching of the references, it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any differences in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)

Appellants have the burden of explaining the data in any declaration they proffer as evidence of non-obviousness. *Ex parte Ishizaka*, 24 USPQ2d 1621, 1624 (Bd. Pat. App. & Inter. 1992).

An Affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. *In re Burckel*, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979).

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to W. David Coleman whose telephone number is 703-305-0004. The examiner can normally be reached on 9:00 AM-5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on 703-308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7721 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

W. David Coleman
Examiner
Art Unit 2823

WDC
October 3, 2002